United Industries Report No. 8601

Energy Survey of Army Dining Facilities at Fort Lewis, Wa.

Contract No. DACA 67-85-C-0085

- ~~Pre~~final Report -

Volume IV

July 31, 1986

Revised February 1987

Prepared for

U.S. Army Corps of Engineers
Seattle District
Seattle, Washington

by

United Industries Corporation
12835 Bell-Red Road
Bellevue, Washington 98005
Tel: (206) 453-8995

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited. Distribution A. Approved for public release.

Marie Wakefield,
Librarian Engineering

1.0 EXECUTIVE SUMMARY

This report is the result of the energy audit and analysis of thirty-eight dining facilities at Fort Lewis, Washington by United Industries Corporation (UIC), according to the scope of work for Contract No. DCAC 67-85-C-0085. The work includes the identification and evaluation of Energy Conservation Opportunities (ECO's) including low cost/no cost ECO's. Program documentation was prepared for selected ECO's with savings investment ratios greater than one (SIR > 1), following Life Cycle Cost Analysis procedures.

The results of six programs are presented herein, including the program documentation for one Energy Conservation Investment Program (ECIP), three Quick Return on Investment Programs (QRIP's), one OSD Productivity Investment Funding (OSD-PIF) and one Productivity Enhancing Capital Investment Program (PECIP). Figure 1-1 is the summary recommended ECO's for these six investment programs.

The QRIP-2 project, insulate piping, includes a total of seventeen dining facilities. This QRIP project will save 1,712 MBTU's per year in fossil fuels. The construction cost of the QRIP-2 project will be $3,822 and will save $9,656 per year with a savings investment ratio (SIR) of 47.0 and with a simple payback of 0.4 years. The simple payback period is defined as the ratio of the construction cost to the annual dollar savings.

The QRIP-1 project, night setback thermostats, includes a total of seven dining facilities. This QRIP project will save 1,821 MBTU's per year in fossil fuels. The project will cost $6,068 and will save $10,694 per year with a savings investment ratio (SIR) of 20.8 and with a simple payback of 0.6 years.

The OSD-PIF project, makeup air for exhaust hoods, includes a total of twenty-four dining facilities. This OSD-PIF project will save 22,079 MBTU's per year in fossil fuels. The project will cost $145,335 and will save $123,384 per year with a savings investment ratio (SIR) of 15.9 and with a simple payback of 1.2 years.

The QRIP-3 project, upgrade HVAC controls, includes a total of six dining facilities. This QRIP-3 project will save 1,550 MBTU's per year in fossil fuels. The project will cost $14,658 and will save $8,507 per year with a savings investment ratio (SIR) of 7.3 and with a simple payback of 1.8 years.

The PECIP project, insulate floors, includes a total of eleven dining facilities. This PECIP project will save 779 MBTU's per year in fossil fuels. The project will cost $13,838 and will save $4,439 per year with a savings investment ratio (SIR) of 5.9 and with a simple payback of 3.1 years. Figure 1-5 shows the existing and proposed energy consumption fof the five non-ECIP programs.

FIGURE 1-1

SUMMARY OF RECOMMENDED ECO'S FOR INVESTMENT PROGRAMS

DATE PREPARED: MARCH 1986
PROGRAM YEAR: FY90

ITEM NO.	PROGRAM DESCRIPTION:	CONSTRUCTION COST (1) ($)	CONSTRUCTION COST PLUS SIOH (5.5%) ($)	PROGRAM YEAR COST (2) ($)	ANNUAL ENERGY SAVINGS: (3) TYPE	(4) (MBTU)	ANNUAL DOLLAR SAVINGS: ($)	PAYBACK (5) (YRS)	SIR (6)
1.	QRIP-2: ECO-17, Insulate Piping	$3,822	$4,032	$5,596	O/G	1712	$9,656	0.4	47.0
2.	QRIP-1: ECO-13, Nite Setback Tstat	$6,068	$6,402	$8,884	O/G	1821	$10,694	0.6	20.8
3.	OSD-PIF: ECO-26, Makeup Air For Exhaust Hoods	$145,335	$153,328	$212,785	O/G	22079	$123,384	1.2	15.9
4.	QRIP-3: ECO-21, Upgrade HVAC Controls	$14,658	$15,464	$21,461	O/G/E	1550	$8,507	1.7	7.3
5.	PECIP: ECO-1B, Insulate Floors	$13,838	$14,599	$20,260	O/G	779	$4,439	3.1	5.9
	(SUBTOTALS:)	$183,721	$193,826	$268,986	O/G/E	27941	$156,680	1.2	NA
6.	ECIP:								
	ECO-1A, Insulate Walls	$14,448	$15,243	$22,317	O	494	$2,816	5.1	3.6
	ECO-3, Weatherstrip & Caulk	$3,722	$3,927	$5,749	O/G/E	133	$730	5.1	3.5
	ECO-22A, Heat Pump Space Heating	$812,796	$857,500	$1,255,465	O/G/E	-4145	$94,571	8.6	1.5
	ECO-23, Opt. Facility Operation	$18,200	$19,201	$28,112	O/E	2708	$8,760	2.1	8.3
	ECO-28, Hot Water Heat Pump	$90,405	$95,377	$139,642	O/G/E	-1545	$17,675	5.1	2.5
	ECO-30, Microwave Ovens	$29,900	$31,545	$46,184	G/E	2464	$4,024	7.4	2.0
	(SUBTOTALS:)	$969,471	$1,022,792	$1,497,470	O/G/E	109	$128,576	7.5	2.5
	(TOTALS:)	$1,153,192	$1,216,618	$1,766,456	O/G/E	28051	$285,256	4.0	NA

NOTES:
(1) Contruction Cost Based on March, 1986 Cost.
(2) Program Year Cost = Const Cost x 1.4641 (Escalated to Midpoint of Contruction: Apr-FY90 @ 10% Per Year).
(3) FUEL TYPE: O = FUEL OIL, E = ELECTRICITY, G = NATURAL GAS
(4) MBTU = MILLION BTU'S.
(5) ELECTRICITY: 1.0 MWH (SITE) = 11.6 MBTU'S (SOURCE).
(6) Payback = Construction Cost / Annual Dollar Savings.
(7) SIR is defined on the Life Cycle Cost Analysis Summary Sheets (LCCASS).

A total of twenty-three dining facilities and six ECO's are included in one ECIP project. This ECIP project will save 31,199 MBTU's per year in fossil fuels (12,178 MBTU's per year of fuel oil; 19,021 MBTU's per year of natural gas) and will consume an additional 31,091 MBTU's per year of electrical energy. The project will cost $969,471 and will save $128,576 per year with a savings investment ratio (SIR) of 2.5, and with a simple payback of 7.5 years.

The total cost of all six programs is $1,153,192 with annual energy savings of 28,051 MBTU's and annual dollar savings of $285,256 and will have a simple payback of 4.0 years (see Figure 1-1).

Savings to investment ratios (SIR's) were calculated for all technically feasible ECO's for each individual building. These SIR's are listed in Figure 1- . mary of ECO's with SIR's greater than one (SIR > 1), is li n Figure 1-3. This figure shows the summation of each ECO f all buildings. Listed are the construction costs, annual energy savings in MBTU's, annual dollar savings, and payback period.

1.1 Summary and Conclusions

1.1.1 Introduction

United Industries Corporation (UIC) conducted an energy analysis survey at thirty-eight dining facilities at Fort Lewis Army Base, Tacoma, Washington. The purpose of the analysis was to identify energy conservation opportunities (ECO's) and to calculate the cost-effectiveness of the ECO's. This report presents the results of this study in four (4) volumes as follows:

1. Volume I - Report Sections: 1 (incl. Executive Summary) thru 6.
2. Volume II - Appendices: A thru L
3. Program Documents Volume
4. Executive Summary Volume

1.1.2 Scope of Work

The original contract called for the survey of forty buildings; however, three buildings were closed or were no longer used as dining facilities (3220, 3221, 3475). One new building (3279) was added to the original list of buildings to be analyzed (see Appendix L, page L-12).

A total of over thirty-one (31) ECO's were analyzed for each building (see Appendix A, pages L-10 and L-11).

FIGURE 1-2
Summary of Life Cycle Cost Analysis - SIR
(Group A Dining Facilities)

ECO NO.	TITLE:	4436	4A16	6A8	6A38	8A27	5B10	6B10	9C28	10C8	4E1	8E23
1A	INSULATE WALLS	3.6	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
1B	INSULATE FLOORS	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
1C	INSULATE CEILINGS	2.4	2.4	3.7	0.2		2.4	2.4			2.4	2.4
2	STORM WINDOWS OR DBL.GLZ.	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
3	WEATHERSTRIP AND CAULK	0.6	0.6	0.6	0.6	0.6	0.6	0.6		1.4	0.6	0.6
4	INSULATE PANELS											
5	SOLAR FILM											
6	VESTIBULES	0.2	0.2	0.2	0.2	0.6		0.2	0.2	0.2	0.2	0.2
7	REDUCTION OF GLASS AREA	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
8	SHUTDOWN DHW AT NIGHT	1.3	0.7	1.0	1.0		0.8	1.1	1.4	0.7		1.0
9	ENERGY CONS. FLUOR.LIGHT											
10	REDUCE LIGHTING LEVELS											
11	REPLACE INCAND. LIGHTS	1.7	1.7	2.3	2.3	2.5	1.8	1.8	2.3	1.7	1.7	2.3
12	USE MORE EFF. LIGHTS											
13	NIGHT SETBACK THERMOSTAT								38.7			
14	INFRARED HEATERS											
15	ECONOMIZER CYCLE											
16	HEAT RECLAIM FROM EXHAUST	1.9	1.2	0.7	1.2	1.2	1.2	1.2	1.2	1.2	1.9	1.2
17	INSULATE PIPING	37.0	37.0	4.9	13.5	70.6	11.7	14.6	16.6	26.7	90.3	17.1
18	DISHWASHER HEAT RECOVERY	1.4	1.4	0.7	1.2	2.5	1.4	1.4	2.1	0.7	2.0	2.0
19	BOOSTER HATERS											
20	LOWER DHW TEMPERATURE			38.7						43.6		
21	UPGRADE HVAC CONTROLS											
22A	HEAT PUMP	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
22B	ELECTRIC RESISTANCE	3.4	10.6	9.3	3.4	3.4	10.6	10.6	10.6	9.3	3.4	3.4
23	OPTIMIZE FACILITY OPER.	100.0		10.1			8.3	8.3				
24	BALANCE HVAC SYSTEM											
25	AIR CURTAINS											
26	MAKE-UP FOR EXHAUST HOODS	6.2	6.2	3.0	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
27	SHUT OFF EXHAUST HOODS	19.9	19.9	10.6	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
28	USE HEAT PUMPS FOR DHW	1.9	1.9	0.6	1.9	3.3	3.3	1.9	3.5	0.9	2.7	2.7
29	REFRIG. WASTE HEAT RECOV.	2.4	2.4	3.5	1.9	1.7	1.2	1.9	1.9	1.7	1.8	2.1
30	USE MICROWAVE OVENS	2.3	2.3	1.2	2.3	2.3	2.3	2.3			2.3	2.3
31	ISOLATION OF KITCHEN											

FIGURE 1-2 (Cont'd)
Summary of Life Cycle Cost Analysis - SIR
(Groups C, D & E Dining Facilities)

ECO NO.	TITLE:	3470	3654	3655	3657	1450	1452	20[illegible]	2015	2020	2027	2400	3757	8085	8989	9980
1A	INSULATE WALLS							0.[illegible]	3	0.3	0.2	0.6	0.3			0.4
1B	INSULATE FLOORS															1.8
1C	INSULATE CEILINGS		0.2													
2	STORM WINDOWS OR DBL. GLZ		0.3	0.3	0.3	0.3		0.9		0.9	0.7	0.5	0.2	0.6		1.0
3	WEATHERSTRIP AND CAULK									0.8		8.6				9.0
4	INSULATE PANELS		0.0	0.0	0.0	0.0	0.									
5	SOLAR FILM											1.6				
6	VESTIBULES															
7	REDUCTION OF GLASS AREA		0.4	0.4	0.4	0.4		0.8	0.8	0.8	0.6	0.8	0.5			2.0
8	SHUTDOWN DHW AT NIGHT											0.2	0.2	0.1	2.8	0.3
9	ENERGY CONS. FLUOR. LIGHT															
10	REDUCE LIGHTING LEVELS															
11	REPLACE INCAN. LIGHTS	3.5	3.5	3.5	3.5	4.9		2.3					4.3			5.9
12	USE MORE EFF. LIGHTS															
13	NIGHT SETBACK THERMOSTAT					13.4		21.7				37.4	37.4	8.4	30.2	15.9
14	INFRARED HEATERS															
15	ECONOMIZER CYCLE															
16	HEAT RECLAIM FROM EXHAUST		3.1	3.1	3.1	3.1		5.6	5.6	5.6	4.4	3.8	5.6	5.1		4.6
17	INSULATE PIPING		51.8	51.8	51.8	56.6	71.2							33.5		
18	DISHWASHER HEAT RECOVERY		2.3	1.4	1.3	2.1	3.8	2.0	1.3	1.4	2.3	2.3	3.4	1.5		3.5
19	BOOSTER HATERS															
20	LOWER DHW TEMPERATURE							32.3	32.3		129.7	230.4	181.3	69.0		363.3
21	UPGRADE HVAC CONTROLS		27.9	27.9	27.9	45.9						1.5		2.3		
22A	HEAT PUMP		1.1	1.1	1.1	1.4	1.8	1.3	1.7	1.7	1.0	1.0	1.7	3.9		1.0
22B	ELECTRIC RESISTANCE		1.9	1.9	1.9	2.8	3.5	3.7	4.9	4.9	3.9	3.4	2.7	5.2		2.1
23	OPTIMIZE FACILITY OPER.															4.4
24	BALANCE HVAC SYSTEM															
25	AIR CURTAINS															
26	MAKE-UP FOR EXHAUST HOODS		16.1	16.1	16.1	23.8	25.7	16.4	16.4	16.4	13.0	18.8	62.8	14.5		15.2
27	SHUT OFF EXHAUST HOODS		42.6	42.6	42.6	53.9	42.6	24.8	24.8	24.8	21.7	79.3	222.0	5.7		3.1
28	USE HEAT PUMP FOR DHW		1.9	1.7	1.2	3.3	3.5	2.0	1.3	2.3	2.8	4.1	2.9	2.2		3.7
29	REFRIG. WASTE HEAT RECOV.		2.0	1.6	2.4	2.4	4.2	1.4	2.[illegible]	1.6	2.2		3.6	0.7		2.6
30	USE MICROWAVE OVENS	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.1	1.1	1.1		0.8
31	ISOLATION OF KITCHEN															
32	AUTOMATIC LIGHT SWITCHES											-1.2				

FIGURE 1-2 (Cont'd)
Summary of Life Cycle Cost Analysis - SIR
(Group B Dining Facilities)

ECO NO.	TITLE:	3114	3119	3157	3165	3213	3218	3224	3279	3281	3416	3417	3421
1A	INSULATE WALLS												
1B	INSULATE FLOORS												
1C	INSULATE CEILINGS												
2	STORM WINDOW OR DBL.GLZ.												
3	WEATHERSTRIP AND CAULK												
4	INSULATE PANELS												
5	SOLAR FILM												
6	VESTIBULES												
7	REDUCTION OF GLASS AREA												
8	SHUTDOWN DHW AT NIGHT												
9	ENERGY CONS. FLUOR. LIGHT												
10	REDUCE LIGHTING LEVELS												
11	REPLACE INCAND. LIGHTS	1.7	1.7	1.7	1.7	1.7		1.7	1.7		0.8	1.7	1.7
12	USE MORE EFF. LIGHTS												
13	NIGHT SETBACK THERMOSTAT												
14	INFRARED HEATERS												
15	ECONOMIZER CYCLE												
16	HEAT RECLAIM FROM EXHAUST												
17	INSULATE PIPING												
18	DISHWASHER HEAT RECOVERY												
19	BOOSTER HATERS												
20	LOWER DHW TEMPERATURE												
21	UPGRADE HVAC CONTROLS												
22A	HEAT PUMP												
22B	ELECTRIC RESISTANCE												
23	OPTIMIZE FACILITY OPER.												
24	BALANCE HVAC SYSTEM												
25	AIR CURTAINS												
26	MAKE-UP FOR EXHAUST HOODS												
27	SHUT OFF EXHAUST HOODS												
28	USE HEAT PUMP FOR DHW												
29	REFRIG. WASTE HEAT RECOV.												
30	USE MICROWAVE OVENS	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
31	ISOLATION OF KITCHEN												

FIGURE 1-3
SUMMARY OF ENERGY ANALYSIS
(Totals For ECO'S With SIR > 1)

ECO NO.	TITLE	CONSTRUCTION COST ($)	ANNUAL ENERGY SAVINGS (MBTU)	ANNUAL ENERGY SAVINGS ($)	PAYBACK (YRS)
1A	INSULATE WALLS	14448	493.6	2816	5.1
1B	INSULATE FLOORS	13838	778.8	4439	3.1
1C	INSULATE CEILINGS	20070	486.6	2772	7.2
2	STORM WINDOWS OR DOUBLE GLZ	9795	97.0	534	18.3
3	WEATHERSTRIP AND CAULK	3722	133.3	730	5.1
4	INSULATE PANELS				
5	SOLAR FILM				
6	VESTIBULES	8232	142.3	752	11.0
7	REDUCTION OF GLASS AREA	7026	141.8	782	9.0
8	SHUTDOWN ENERGY TO HOT	595	17.5	63	9.4
9	ENERGY CONSERV. FLUOR. LITES				
10	REDUCE LIGHTING LEVELS				
11	REPLACE INCANDESCENT	11981	953.3	1393	8.6
12	USE MORE EFFICIENT LIGHTS				
13	NIGHT SETBACK THERMOSTAT	6068	1821.4	10694	0.6
14	INFRARED HEATERS				
15	ECONOMIZER CYCLE				
16	KITCHEN EXHAUST HEAT RECLAIM	456231	16666.7	92604	4.9
17	INSULATE PIPING	3822	1711.6	9656	0.4
18	DISHWASHER HEAT RECOVERY	89705	1826.6	10207	8.8
19	BOOSTER HEATERS				
20	LOWER DOMESTIC HOT WATER	131	171.1	945	0.1
21	UPGRADE HVAC CONTROLS	14658	1550.3	8507	1.7
22A	HEAT PUMP	812796	-4145.2	94571	8.6
22B	REDUCE BOILER CAPACITY	300	39.2	224	1.3
22B	INTERMIT. IGN. ON FURNACES	2976	276.5	1575	1.9
22B	DESTRATIFICATION FANS	6241	322.2	1722	3.6
22B/C	ELECTRIC RESISTANCE	345540	-39332.4	67998	5.1
22D	CONVERT TO VAV	25400	122.2	279	91.0
23	OPTIMIZE FACILITY OPERATION	18200	2707.9	8760	2.1
24	BALANCE HVAC SYSTEM				
25	AIR CURTAINS				
26	MAKE-UP FOR EXHAUST HOODS	145335	22078.5	123384	1.2
27	SHUT OFF RANGE HOODS	2251	1112.4	6181	0.4
28	USE HEAT PUMP TO HEAT	90405	-1544.7	17675	4.7
29	REFRIGERATION WASTE HEAT	189834	4347.0	23999	7.9
30	USE OF MICROWAVE OVENS	29900	2463.4	4024	7.4
31	ISOLATION OF KITCHEN				
32	AUTOMATIC LIGHT SWITCHES	772	327.3	77	10.0

Cost effectiveness of each technically feasible ECO has been analyzed utilizing methods as prescribed on the Life Cycle Cost Analysis Summary Sheet (LCCASS). Program documentation for six (6) projects are presented in Volume III.

1.1.3 Methodology

Field surveys were conducted at each building and relevant information on existing equipment and operating conditions were recorded. The thirty-eight dining facilities were divided into five groups according to similarities in construction materials, occupancy patterns, and equipment inventories as listed below:

Group A (11 Bldgs.)		Broup B (12 Bldgs.)		Group C (6 Bldgs.)	Group D (4 Bldgs.)	Group E (5 Bldgs.)
4436	6B10	3114	3224	3470	2006	2400
4A16	9C28	3119	3281	3654	2015	3757
6A8	10C8	3157	3416	3655	2020	8085
6A38	4E1	3165	3417	3657	2027	8989
8A27	8E23	3213	3421	1450		9980
5B10		3218	3279	1452		

A computer model was developed for at least one building in each group utilizing the "Elite" computer program (see Appendix K). The model was used to predict baseline energy usage of the existing facilities and the energy usage of the idning faciltites after incorporation of an ECO. The computer program calculates peak energy usage and energy usage by systems. The results are presented in the Appendices in Volume II. The savings for some ECO's were hand calculated. Cost estimates were developed based on supplier quotes and cost estimating handbooks. Life cycle costs were also performed using Army Corps supplied information on energy costs and discount factors.

Analysis results were applied to other buildings within a group when conditions between the buildings were similar. ECO's were reanalyzed in subsequent buildings if conditions between the buildings were dissimilar.

1.1.4 Results of Analyses

A summary of recommended ECO's for various funding programs is listed in Figure 1-1 in descending order of their savings to investment ratio (SIR).

A summary of analysis results is presented in Figures 1-2 and 1-3. The savings-to-investment ratio (SIR) for the technically feasible ECO's are listed by building in Figure 1-2. Additionally, Figure

1-3 lists the total cost, energy savings and dollar savings that would result if individual ECO's were implemented in every building. It is important to remember when reviewing the results that each ECO was first analyzed independently. Many ECO's affect the same energy system and, thus, some savings estimates have been decreased due to interactive effects between ECO's. When multiple ECO's were analyzed in one building, the interactive effects were considered in preparing the Energy Conservation Investment Program (ECIP) documents.

Important results and findings of the energy analysis, in addition to the economic information in Figures 1-2 and 1-3, include:

- Energy use and costs can be roughly divided into end-use categories as follows: heating - 55%; kitchen equipment - 21%; domestic hot water - 16%; lights - 8% (see Figure 1-4).

- About 80% of the space heating load is due to heating outside make-up air for exhaust hoods.

- Largest energy savings will result from ducting unheated outside air directly to exhaust hoods.

- Most buildings practice night setback of temperature.

- Exhaust hoods, range tops, ovens and other kitchen equipment are occasionally left on when not in use even though "energy awareness" stickers are typically posted. Explanations given by operators were that they didn't know the equipment was on (exhaust hoods) or the thermal lag time for ranges and ovens makes it inconvenient to turn them off between use. Educating operators as to the benefits of turning hoods off (in the winter) and the actual lag times for appliances may be a solution.

- Electricity costs less than natural gas or oil at Ft. Lewis. Therefore, lighting measures, such as reducing light levels or replacing incandescent lamps, are not cost-effective because the increased space heating costs are greater than the electric dollar savings.

- Electric resistance heaters are typically more cost-effective than heat pumps because of their low installed cost even though heat pumps save more total energy.

- Few buildings have wall or ceiling insulation.

- Few buildings have double pane windows, however installing storm windows is typically not cost-effective.

- Most pipes and tanks are well insulated. It is very cost-effective to insulate those few that are uninsulated.

- Booster heaters for dishwashers are in 95% of kitchens.

- Domestic hot water set temperatures range from 135°F to 190°F and average about 155°F. More than half of the food service sergeants reported at least occasional hot water shortages. This is the reason that most set points are above 140°F.

- Three sources of waste heat are available for heating hot water: dishwasher waste water, refrigeration condenser heat, and ambient kitchen heat for a heat pump water heater. All three options typically payback in about eight years and have SIR's of about 2.5. Since all three ECO's deal with water heating, only one will be cost effective.

- Food service sergeants were very cooperative with survey team and are willing to conserve energy as long as it doesn't interfere with their food service activities.

- Majority of food service sergeants did not want microwave ovens. They have small capacities which require more operator attention and the operators would have to be trained to operate them. It is also unclear if other appliances would be turned off as a result of the microwave ovens.

Figure 1-4

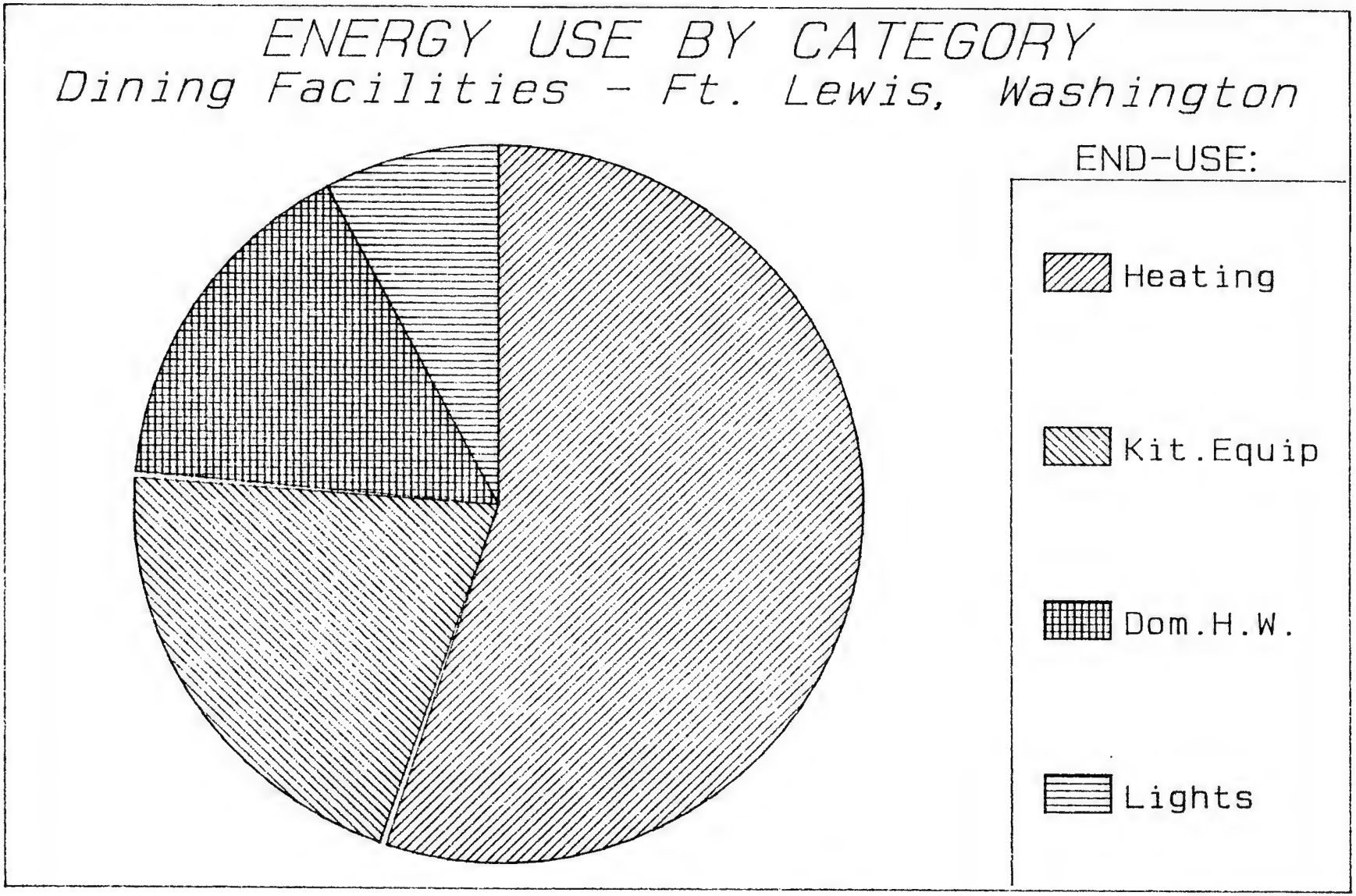
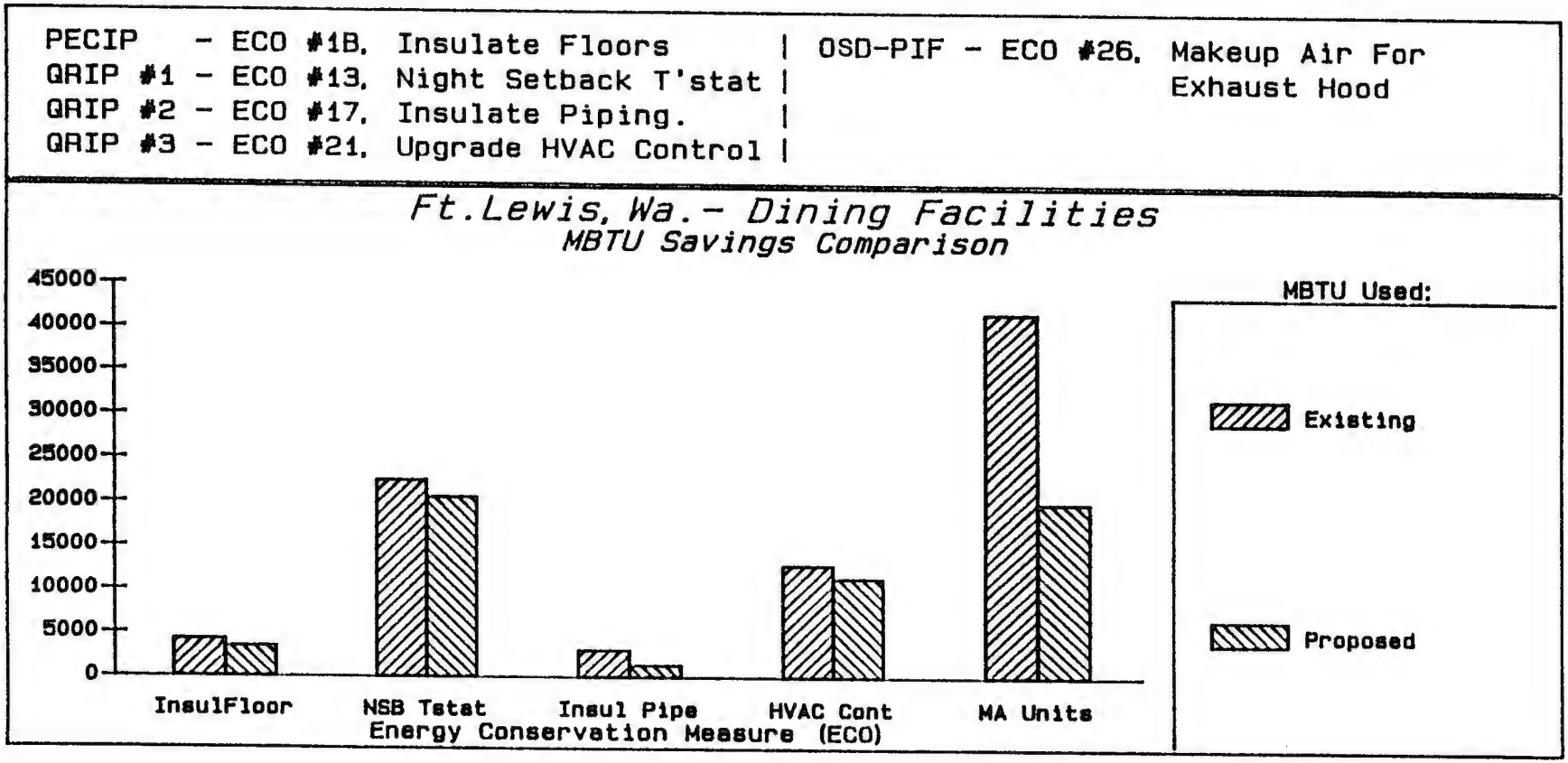

ENERGY USE BY CATEGORY
Dining Facilities - Ft. Lewis, Washington
END-USE:
Heating
Kit.Equip
Dom.H.W.
Lights

FIGURE 1-5


PECIP - ECO #1B, Insulate Floors
QRIP #1 - ECO #13, Night Setback T'stat
QRIP #2 - ECO #17, Insulate Piping.
QRIP #3 - ECO #21, Upgrade HVAC Control
OSD-PIF - ECO #26, Makeup Air For Exhaust Hood
Ft.Lewis, Wa.- Dining Facilities
MBTU Savings Comparison
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
InsulFloor
NSB Tstat
Insul Pipe
HVAC Cont
MA Units
Energy Conservation Measure (ECO)
MBTU Used:
Existing
Proposed

SUMMARY OF COST ESTIMATES FOR
ECO # 1A - INSULATE WALLS

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4436	182	1134	1316	490	1806
2.	T4A16	182	1134	1316	490	1806
3.	T6A38	182	1134	1316	490	1806
4.	T8A27	182	1134	1316	490	1806
5.	T9C28	182	1134	1316	490	1806
6.	T10C8	182	1134	1316	490	1806
7.	T4E1	182	1134	1316	490	1806
8.	T8E23	182	1134	1316	490	1806
	TOTALS:	$1,456	$9,072	$10,528	$3,920	$14,448

SUMMARY OF ECO #1A - INSULATE WALLS

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	ANNUAL ENERGY SAVINGS: (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$1,806	377.9	316.2	61.7	$352	5.1	3.6
2.	T4A16	$1,806	377.9	316.2	61.7	$352	5.1	3.6
3.	T6A38	$1,806	377.9	316.2	61.7	$352	5.1	3.6
4.	T8A27	$1,806	377.9	316.2	61.7	$352	5.1	3.6
5.	T9C28	$1,806	377.9	316.2	61.7	$352	5.1	3.6
6.	T10C8	$1,806	377.9	316.2	61.7	$352	5.1	3.6
7.	T4E1	$1,806	377.9	316.2	61.7	$352	5.1	3.6
8.	T8E23	$1,806	377.9	316.2	61.7	$352	5.1	3.6
TOTALS:		$14,448	3023.2	2529.6	493.6	$2,816	5.1	3.6

SUMMARY OF COST ESTIMATES
ECO # 1B - INSULATE FLOORS

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4336	442	509	949	309	1258
2.	T4A16	442	509	949	309	1258
3.	T6A8	442	509	949	309	1258
4.	T6A8	442	509	949	309	1258
5.	T6A38	442	509	949	309	1258
6.	T5B10	442	509	949	309	1258
7.	T6B10	442	509	949	309	1258
8.	T9C28	442	509	949	309	1258
9.	T10C8	442	509	949	309	1258
10.	T4E1	442	509	949	309	1258
11.	T8E23	442	509	949	309	1258
	TOTALS:	$4,862	$5,599	$10,439	$3,399	$13,838

SUMMARY OF ECO # 1B - INSULATE FLOORS

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	FIRST YEAR SAVINGS (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$1,258	377.9	307.1	70.8	$404	3.1	5.9
2.	T4A16	$1,258	377.9	307.1	70.8	$404	3.1	5.9
3.	T6A8	$1,258	377.9	307.1	70.8	$404	3.1	5.9
4.	T6A38	$1,258	377.9	307.1	70.8	$404	3.1	5.9
5.	T8A27	$1,258	377.9	307.1	70.8	$404	3.1	5.9
6.	T5B10	$1,258	377.9	307.1	70.8	$404	3.1	5.9
7.	T6B10	$1,258	377.9	307.1	70.8	$404	3.1	5.9
8.	T9C28	$1,258	377.9	307.1	70.8	$404	3.1	5.9
9.	T10C8	$1,258	377.9	307.1	70.8	$404	3.1	5.9
10.	T4E1	$1,258	377.9	307.1	70.8	$404	3.1	5.9
11.	T8E23	$1,258	377.9	307.1	70.8	$404	3.1	5.9
TOTALS:		$13,838	4156.9	3378.1	778.8	$4,439	3.1	5.9

SUMMARY OF COST ESTIMATES FOR
ECO #3 - WEATHERSTRIP & CAULK

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T10C8	559	1390	1676	992	2668
2.	2400	244	143	388	105	493
3.	9980	234	205	439	122	561
	TOTALS:	$1,037	$1,738	$2,503	$1,219	$3,722

SUMMARY OF ECO #3 - WEATHERSTRIP & CAULK

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	ANNUAL ENERGY SAVINGS: (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T10C8	$2,668	377.9	342.2	35.7	$203	13.1	1.4
2.	2400	$493	3856.0	3810.4	45.6	$241	2.0	8.6
3.	9980	$561	4435.0	4383.0	52.0	$286	2.0	9.0
TOTALS:		$3,722	8668.9	8535.6	133.3	$730	5.1	3.5

SUMMARY OF COST ESTIMATES FOR ECO # 13 - NIGHT SETBACK THERMOSTAT

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T9C28	94	20	114	14	128
2.	1450	94	20	114	14	128
3.	2006	45	111	156	54	210
4.	2400	1140	337	1477	177	1654
5.	8085	1026	633	1659	200	1859
6.	8989	472	408	880	187	1067
7.	9980	752	160	912	110	1022
	TOTALS:	$3,623	$1,689	$5,312	$756	$6,068

SUMMARY OF ECO # 13 - NIGHT SETBACK THERMOSTAT

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	FIRST YEAR SAVINGS (MBTU/YR)	FIRST YEAR SAVINGS ($)	PAYBACK (Yrs)	SIR
1.	T9C28	$128	520.9	449.4	71.5	$408	0.3	38.7
2.	1450	$128	176.5	151.8	24.7	$141	0.9	13.4
3.	2006	$210	1872.5	1806.7	65.8	$375	0.6	21.7
4.	2400	$1,654	8031.3	7061.1	970.2	$4,856	0.3	37.4
5.	8085	$1,859	7045.3	6824.1	221.2	$1,212	1.7	8.4
6.	8989	$1,067	422.0	184.0	238.0	$2,437	0.4	30.2
7.	9980	$1,022	4435.0	4205.0	230.0	$1,265	0.8	15.9
TOTALS:		$6,068	22503.5	20682.1	1821.4	$10,694	0.6	20.8

SUMMARY OF COST ESTIMATES
ECO # 17 - INSULATE PIPING

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4436	82	120	202	64	266
2.	T4A16	52	88	140	47	187
3.	T6A8	106	162	268	87	355
4.	T6A38	38	51	89	27	116
5.	T8A27	112	187	299	111	410
6.	T5B10	16	24	40	13	53
7.	T6B10	24	34	58	18	76
8.	T9C28	23	34	57	18	75
9.	T10C8	15	25	40	13	53
10.	T4E1	33	45	78	28	106
11.	T8E23	25	61	86	31	117
12.	3654	89	128	217	71	288
13.	3655	89	128	217	71	288
14.	3657	89	128	217	71	288
15.	1450	236	377	613	202	815
16.	1452	69	113	182	61	243
17.	8085	31	35	66	20	86
	TOTALS:	$1,129	$1,740	$2,869	$953	$3,822

SUMMARY OF ECO # 17 - INSULATE PIPING

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	FIRST YEAR SAVINGS (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$266	94.2	14.1	80.1	$457	0.6	31.6
2.	T4A16	$187	72.9	6.9	66.0	$376	0.5	37.0
3.	T6A8	$355	20.3	3.6	16.7	$95	3.7	5.5
4.	T6A38	$116	18.5	4.5	14.9	$85	1.4	15.0
5.	T8A27	$410	294.1	18.1	276.0	$1,573	0.3	78.7
6.	T5B10	$53	6.9	1.0	5.9	$34	1.6	13.0
7.	T6B10	$76	12.8	2.2	10.6	$60	1.3	16.3
8.	T9C28	$75	14.0	2.1	11.9	$68	1.1	18.6
9.	T10C8	$53	14.8	1.3	13.5	$77	0.7	29.8
10.	T4E1	$117	108.7	8.0	100.7	$574	0.2	100.7
11.	T8E23	$106	20.3	3.0	17.3	$99	1.1	19.1
12.	3654	$288	175.3	21.3	154.0	$847	0.3	58.0
13.	3655	$288	175.3	21.3	154.0	$847	0.3	58.0
14.	3657	$288	175.3	21.3	154.0	$847	0.3	58.0
15.	1450	$815	660.0	220.0	440.0	$2,508	0.3	63.0
16.	1452	$243	183.0	18.0	165.0	$941	0.3	79.0
17.	8085	$86	35.1	4.1	31.0	$168	0.5	38.3
TOTALS:		$3,822	2081.5	370.8	1711.6	$9,656	0.4	47.0

SUMMARY OF COST ESTIMATES FOR
ECO # 21 - UPGRADE HVAC CONTROLS

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	1450	336	114	450	45	495
2.	2400	3125	0	3125	313	3438
3.	3654	336	114	450	45	495
4.	3655	672	228	900	90	990
5.	3657	672	228	900	90	990
6.	8085	7500	0	7500	750	8250
	TOTALS:	$12,641	$684	$13,325	$1,333	$14,658

SUMMARY OF ECO # 21 - UPGRADE HVAC CONTROLS

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	FIRST YEAR SAVINGS (MBTU/YR)	FIRST YEAR SAVINGS ($)	PAYBACK (Yrs)	SIR
1.	1450	$495	1232.9	911.7	321.0	$1,766	0.3	45.9
2.	2400	$3,438	3116.6	3023.1	93.5	$514	6.7	1.5
3.	3654	$495	271.0	202.5	68.5	$377	1.3	9.8
4.	3655	$990	1503.9	1114.4	389.5	$2,143	0.5	27.9
5.	3657	$990	1503.9	1114.4	389.5	$2,143	0.5	27.9
6.	8085	$8,250	5762.6	5474.3	288.3	$1,564	5.3	2.3
TOTALS:		$14,658	13390.9	11840.4	1550.3	$8,507	1.7	7.3

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4436	5040	2176	7216	1514	8730
2.	T4A16	5040	2176	7216	1514	8730
3.	T6A38	5040	2176	7216	1514	8730
4.	T8A27	5040	2176	7216	1514	8730
5.	T9C28	5040	2176	7216	1514	8730
6.	T10C8	5040	2176	7216	1514	8730
7.	T4E1	5040	2176	7216	1514	8730
8.	T8E23	5040	2176	7216	1514	8730
9.	3654	31400	7006	38406	6169	44575
10.	3655	31400	7006	38406	6169	44575
11.	3657	31400	7006	38406	6169	44575
12.	1450	34540	7707	42247	6786	49033
13.	1452	22958	5123	28081	4511	32592
14.	2006	25827	6173	32000	5061	37061
15.	2015	25689	5854	31543	5008	36551
16.	2020	25689	5854	31543	5008	36551
17.	2027	25689	5854	31543	5008	36551
18.	2400	69760	19562	89322	13998	103320
19.	3757	78246	21988	100234	15788	116022
20.	8085	49200	12536	61736	9670	71406
21.	9980	54226	21587	75813	14331	90144
	TOTALS:	$546,344	$150,664	$697,008	$115,788	$812,796

SUMMARY OF ECO # 22A - HEAT PUMP SPACE HEATING

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	ANNUAL ENERGY SAVINGS: (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
2.	T4A16	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
3.	T6A38	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
4.	T8A27	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
5.	T9C28	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
6.	T10C8	$8,730	280.5	215.1	65.4	$1,284	6.8	1.6
7.	T4E1	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
8.	T8E23	$8,730	316.2	242.5	73.7	$1,448	6.0	1.8
9.	3654	$44,575	1114.0	1475.0	-361.0	$3,521	12.7	1.1
10.	3655	$44,575	1114.0	1475.0	-361.0	$3,521	12.7	1.1
11.	3657	$44,575	1114.0	1475.0	-361.0	$3,521	12.7	1.1
12.	1450	$49,033	1485.0	1512.0	-27.0	$5,625	8.7	1.4
13.	1452	$32,592	1043.0	1061.0	-18.0	$3,955	8.2	1.8
14.	2006	$37,061	896.0	913.6	-17.6	$3,773	9.8	1.3
15.	2015	$36,551	1280.0	1302.0	-22.0	$4,852	7.5	1.7
16.	2020	$36,551	1280.0	1302.0	-22.0	$4,852	7.5	1.7
17.	2027	$36,551	1097.0	1242.9	-145.9	$3,042	12.0	1.0
18.	2400	$103,320	3855.7	4221.7	-366.0	$7,255	14.2	1.0
19.	3757	$116,022	4378.0	5797.0	-1419.0	$13,848	8.4	1.7
20	8085	$71,406	5656.0	6623.0	-967.0	$19,152	3.7	3.8
21.	9980	$90,144	4383.0	5022.0	-639.0	$6,234	14.5	1.0
TOTALS:		$812,796	31189.6	35334.8	-4145.2	$94,571	8.6	1.5

SUMMARY OF ECO # 23 - OPTIMIZE FACILITY OPERATION

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	ANNUAL ENERGY SAVINGS: (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T6A8	$3,200	377.9	0.0	377.9	$2,154	1.8	12.4
2.	T5B10	$7,500	1952.0	787.0	1165.0	$3,303	2.3	7.4
3.	T6B10	$7,500	1952.0	787.0	1165.0	$3,303	2.3	7.4
TOTALS:		$18,200	4281.9	1574.0	2707.9	$8,760	2.1	8.3

SUMMARY OF COST ESTIMATES FOR
ECO # 26 - MAKE-UP AIR FOR EXHAUST HOODS

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4336	1947	1482	3429	774	4203
2.	T4A16	1947	1482	3429	774	4203
3.	T6A8	1947	1482	3429	774	4203
4.	T6A38	1947	1482	3429	774	4203
5.	T8A27	1947	1482	3429	774	4203
6.	T5B10	1947	1482	3429	774	4203
7.	T6B10	1947	1482	3429	774	4203
8.	T9C28	1947	1482	3429	774	4203
9.	T10C8	1947	1482	3429	774	4203
10.	T4E1	1947	1482	3429	774	4203
11.	T8E23	1947	1482	3429	774	4203
12.	3654	2081	2351	4432	1204	5636
13.	3655	2081	2351	4432	1204	5636
14.	3657	2081	2351	4432	1204	5636
15.	1450	3234	2230	5464	1345	6809
16.	1452	1264	877	2141	471	2612
17.	2006	3088	3237	6325	1803	8128
18.	2015	3088	3237	6325	1803	8128
19.	2020	3088	3237	6325	1803	8128
20.	2027	3088	3237	6325	1803	8128
21.	2400	4195	1823	6018	1148	7166
22.	3757	1402	3171	4573	1385	5958
23.	8085	3618	2402	6020	1347	7367
24.	9980	9574	6394	15968	3802	19770
	TOTALS:	$63,299	$53,200	$116,499	$28,836	$145,335

SUMMARY OF ECO # 26 - MAKE-UP AIR FOR EXHAUST HOODS

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	FIRST YEAR SAVINGS (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
2.	T4A16	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
3.	T6A8	$4,203	377.9	246.6	131.3	$748	5.6	3.0
4.	T6A38	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
5.	T8A27	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
6.	T5B10	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
7.	T6B10	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
8.	T9C28	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
9.	T10C8	$4,203	377.9	246.6	131.3	$748	5.6	3.0
10.	T4E1	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
11.	T8E23	$4,203	377.9	128.9	249.0	$1,419	3.0	6.2
12.	3654	$5,636	1113.9	173.9	940.0	$5,170	1.1	16.7
13.	3655	$5,636	1113.9	173.9	940.0	$5,170	1.1	16.7
14.	3657	$5,636	1113.9	173.9	940.0	$5,170	1.1	16.7
15.	1450	$6,809	1827.0	285.0	1542.0	$8,789	0.8	24.5
16.	1452	$2,612	1043.0	403.0	640.0	$3,648	0.7	26.5
17.	2006	$8,128	1873.0	599.1	1273.9	$7,261	1.1	17.0
18.	2015	$8,128	1873.0	599.1	1273.9	$7,261	1.1	17.0
19.	2020	$8,128	1873.0	599.1	1273.9	$7,261	1.1	17.0
20.	2027	$8,128	1873.0	599.1	1273.9	$7,261	1.1	17.0
21.	2400	$7,166	6478.4	5058.4	1393.0	$7,662	0.9	19.4
22.	3757	$5,958	4378.0	510.0	3868.0	$21,274	0.3	60.0
23.	8085	$7,367	9380.1	8275.8	1104.3	$6,074	1.2	14.9
24.	9980	$19,770	4435.0	1323.0	3112.0	$17,116	1.2	38.3
TOTALS:		$145,335	42532.1	20426.6	22078.5	$123,384	1.2	15.9

SUMMARY OF COST ESTIMATES FOR
ECO #28 - HOT WATER HEAT PUMP

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4436	1939	972	2911	437	3348
2.	T4A16	1939	972	2911	437	3348
3.	T6A38	1939	972	2911	437	3348
4.	T8A27	1939	972	2911	437	3348
5.	T9C28	1939	972	2911	437	3348
6.	T4E1	1939	972	2911	437	3348
7.	T8E23	1939	972	2911	437	3348
8.	3654	3031	1519	4550	683	5233
9.	3655	3031	1519	4550	683	5233
10.	3657	3031	1519	4550	683	5233
11.	1450	2487	1276	3763	564	4327
12.	1452	4878	993	5841	876	6717
13.	2006	1939	972	2911	437	3348
14.	2015	1939	972	2911	437	3348
15.	2020	1939	972	2911	437	3348
16.	2027	1939	972	2911	437	3348
17.	2400	1939	972	2911	437	3348
18.	3757	8531	1530	10061	1509	11570
19.	8085	3031	1519	4550	683	5233
20.	9980	4818	993	5811	872	6683
	TOTALS:	$56,106	$22,532	$78,608	$11,797	$90,405

SUMMARY OF ECO # 28 - HOT WATER HEAT PUMP

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	ANNUAL ENERGY SAVINGS: (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$3,348	126.0	150.0	-24.0	$474	7.1	1.9
2.	T4A16	$3,348	126.0	150.0	-24.0	$474	7.1	1.9
3.	T6A38	$3,348	126.0	150.0	-24.0	$474	7.1	1.9
4.	T8A27	$3,348	220.5	262.5	-42.0	$874	3.8	3.3
5.	T9C28	$3,348	232.0	276.0	-44.0	$919	3.6	3.5
6.	T4E1	$3,348	182.0	217.0	-35.0	$721	4.6	2.7
7.	T8E23	$3,348	182.0	217.0	-35.0	$721	4.6	2.7
8.	3654	$5,233	190.0	259.0	-69.0	$667	7.8	1.9
9.	3655	$5,233	171.0	232.0	-61.0	$602	8.7	1.7
10.	3657	$5,233	115.6	157.3	-41.7	$406	12.9	1.6
11.	1450	$4,327	216.5	294.3	-77.8	$804	5.4	2.4
12.	1452	$6,717	501.0	681.0	-180.0	$1,861	3.6	3.5
13.	2006	$3,348	201.2	273.5	-72.3	$707	4.7	3.0
14.	2015	$3,348	126.8	172.3	-45.5	$446	7.5	1.8
15.	2020	$3,348	157.5	214.1	-56.6	$554	6.0	2.3
16.	2027	$3,348	280.0	380.5	-100.5	$984	3.4	4.2
17.	2400	$3,348	275.6	374.6	-99.0	$969	3.5	4.1
18.	3757	$11,570	708.6	963.3	-254.7	$2,491	4.6	2.9
19.	8085	$5,233	218.7	297.3	-78.6	$769	6.8	2.2
20.	9980	$6,683	503.0	683.8	-180.0	$1,758	3.8	3.7
TOTALS:		$90,405	4860.0	6405.5	-1544.7	$17,675	5.1	2.5

SUMMARY OF COST ESTIMATES FOR
ECO #30 - USE MICROWAVE OVENS

ITEM NO.	BUILDING NO.	MATERIAL COST ($)	LABOR COST ($)	SUBTOTAL ($)	OVERHEAD & PROFIT ($)	CONSTRUCTION COST ($)
1.	T4436	3000	0	3000	450	3450
2.	T4A16	3000	0	3000	450	3450
3.	T6A38	3000	0	3000	450	3450
4.	T8A27	3000	0	3000	450	3450
5.	T4E1	3000	0	3000	450	3450
6.	T8E23	3000	0	3000	450	3450
7.	2400	4000	0	4000	600	4600
8.	8085	4000	0	4000	600	4600
	TOTALS:	$26,000	$0	$35,000	$5,250	$40,250

SUMMARY OF ECO #30 - USE MICROWAVE OVENS

ITEM NO.	BUILDING NO.	CONSTRUCTION COST ($)	PRESENT ENERGY USE (MBTU/YR)	PROPOSED ENERGY USE (MBTU/YR)	ANNUAL ENERGY SAVINGS: (MBTU/YR)	($)	PAYBACK (Yrs)	SIR
1.	T4436	$3,450	1040.0	647.0	393.0	$574	6.0	2.3
2.	T4A16	$3,450	1040.0	647.0	393.0	$574	6.0	2.3
3.	T6A38	$3,450	1040.0	647.0	393.0	$574	6.0	2.3
4.	T8A27	$3,450	1040.0	647.0	393.0	$574	6.0	2.3
5.	T4E1	$3,450	1040.0	647.0	393.0	$574	6.0	2.3
6.	T8E23	$3,450	1040.0	647.0	393.0	$574	6.0	2.3
7.	2400	$4,600	875.6	822.9	52.7	$290	15.9	1.1
8.	8085	$4,600	875.6	822.9	52.7	$290	15.9	1.1
TOTALS:		$29,900	7991.2	5527.8	2463.4	$4,024	7.4	2.0